Pipeline Planning and Construction
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There are thousands of pipelines crisscrossing the globe, both onshore and offshore. Designing, constructing, and operating these pipelines and their appurtenant facilities require special skills along with experience. Design criteria and construction techniques differ from area to area and knowing where and how to access such criteria is essential for pipeline professionals.

This book was prepared in order to give engineers and technicians a working knowledge of the processes of planning, designing, and construction of a pipeline system. The idea for the book was conceived by Elsevier Senior Acquisitions Editor, Kenneth McCombs, in consultation with Shashi Menon, a professional engineer with over 37 years of experience in the US Oil and Gas industry. In addition, we assembled a team of experts with over 180 years combined experience throughout the United States and the world to collaborate on the book and produce a relevant and useful reference manual for pipeline planning and construction.

Chapter 1 covers the design basis that forms the foundation for the design of pipelines, pump stations, compressor stations, valves, and other facilities that comprise the pipeline system.

Chapter 2 introduces the various things that must be taken into consideration in selecting a pipeline route and how a route may be selected and changed as it is being developed.

Chapter 3 reviews pipeline regulatory and environmental permits. This includes numerous permits and approvals that must be obtained from state, federal, and local agencies.

Chapter 4 covers the right-of-way (ROW) aspects including the responsibility of ROW team to provide the project a continuous constructible strip of land for the construction of the pipeline and all related surface facilities, including a continuous pipeline right-of-way, all additional work spaces, surface sites for compressor stations, pump stations, meters, valves, and storage sites.

Chapter 5 describes how pipeline alignment sheets are prepared, the information that is included on them and their use.

Chapter 6 is an overview of pipeline materials. The chapter describes how materials for a pipeline are selected taking into consideration the pipeline service, operating conditions, and the appropriate regulations that must be followed.

Chapter 7 is a discussion of the strength capabilities of a pipeline that is subject to internal pressure and how the required pipe wall thickness is calculated.

Chapter 8 explains pipeline hydraulic analysis for both liquid and gas pipelines. The chapter reviews the different types of flow, Reynolds number, and
pressure drop due to friction and determining pumping pressure requirements and location of pump stations and compressor stations.

Chapter 9 covers the calculation of the pressure required in series and parallel piping. In addition, the pumping power required and the number of pumps or compressor stations needed for a long transmission pipeline are discussed.

Chapter 10 reviews requirements of multiple valve stations along a pipeline necessary for isolating segments of pipelines for repair work and in case of a leak, damage, or rupture. In addition, valves installed at pipeline branch connections for delivery or receipt of product being shipped on the mainline are also discussed.

Chapter 11 explains the pump stations and pumping configurations in liquid pipelines along with the optimum locations of pump stations for hydraulic balance. Centrifugal pumps and positive displacement pumps and their performance characteristics are reviewed. The use of variable speed pumps to save pumping power under different operating conditions is also discussed.

Chapter 12 explains the approach to sizing compressor stations in gas pipelines. The optimum locations and pressures at which compressor stations operate are reviewed. Centrifugal and positive displacement compressors used in natural gas transportation are compared with reference to their performance characteristics and cost.

Chapter 13 discusses pipeline corrosion, how corrosion occurs, and the method employed to protect liquid and gas pipelines and associated facilities from corrosion damage.

Chapter 14 introduces the provisions for leak detection for a pipeline. Pipeline operators must take the necessary preparations to eliminate or greatly reduce the possibility of a leak from their system.

Chapter 15 discusses pipeline pigging and internal inspection. Pigging of a pipeline is essential for effective and efficient operation and maintenance. This results in increased pipeline efficiency and extends its useful life.

Chapter 16 discusses pipeline construction with reference to federal, state, district, and local regulations.

Chapter 17 discusses welding and nondestructive testing (NDT) of liquid and gas pipelines. Pipe welding procedures, double jointing, welder qualification, automatic welding, radiography, weld rejection criteria are reviewed.

Chapter 18 discusses hydrostatic testing to ensure integrity of pipeline in service. The federal regulations such as CFR Title 49, Part 195 for Hazardous Liquid Pipelines and CFR Title 49, Part 192 for Gas Pipelines are reviewed.

Chapter 19 describes the preparation and steps to commission or place a pipeline into operation.

Chapter 20 covers specification writing, data sheet production, requisition development, and bid analysis for pipeline materials and equipment.

Chapter 21 describes the information that is included in operations and maintenance manuals and the preparation of these manuals.
The authors would like to acknowledge the many suggestions and constructive comments received from their peers who reviewed portions of the manuscript. Special thanks to David W. Sinclair for his assistance in the review of Chapters 3 and 4 of this manual. Mr. Sinclair, a right-of-way executive for more than 30 years, has been a strong supporter of education and professionalism through the International Right of Way Association (IRWA). In addition, the authors would like to thank their families for being understanding during the many hours spent writing, revising, and proofreading the manuscript and subsequent page proofs.

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Authors have exercised care and diligence to contact copyright holders for permission to use published reference materials. We have also worked hard to eliminate errors and omissions. Readers are encouraged to independently check calculations and verify results prior to using them in their projects. We welcome notifications of corrections and suggestions for improvement of this field manual in subsequent edition.

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